***For consulting on any bite mark case, and/or copies of exhibits cited in this motion, contact Innocence Project attorneys Dana Delger (******ddelger@innocenceproject.org******) or Chris Fabricant (******cfabricant@innocenceproject.org***)

**Model Motion to Preclude Bite Mark Evidence Under *Frye v. United States***

Defendant John Doe, through his undersigned attorney, files this motion to preclude any “bite mark” evidence at his trial. Although such evidence has been previously by courts in [JURISDICTION], the ground has shifted in the [years/decades] since courts in [JURISDICTION] have addressed the admissibility of this technique, and today, science and scientists have utterly rejected bite mark analysis as completely unvalidated and unreliable. *See Starks v. City of Waukegan*, 123 F. Supp. 3d 1036, 1052 (N.D. Ill. July 24, 2015) (finding it “doubtful that ‘expert’ bite mark analysis would pass muster under Federal Rule of Evidence 702 in a case tried in federal court,” because FRE 702(c) requires that “expert testimony be ‘the product of reliable principles and methods’”). Notably, bite mark evidence of the type that the [STATE/Government] intends to offer at trial in this case was proffered to the jury in at least 17 cases (including two death penalty cases) where innocent individuals were wrongfully convicted and later exonerated. An additional seven innocent defendants were wrongfully indicted based on bite mark evidence but exonerated prior to trial. *See* Ex. Q (Innocence Project, *List of Wrongful Bite Mark Convictions and Indictments*)[1](#_bookmark0). Such evidence thus fails the admissibility tests set forth by *Frye v. United States*, 293 F. 1013 (D.C. 1923) and [STATE] Rules of Evidence [702 Equivalent] and [FRE 403 Equivalent]. Its introduction, moreover, would violate Mr.

Doe’s right to a fair trial, free of false evidence, under both the federal and state constitutions. Mr. Doe accordingly moves to preclude any bite mark evidence from being offered at his trial.

1 Also available at [https://www.innocenceproject.org/wp-content/uploads/2017/01/Description-of-bite-mark-](https://www.innocenceproject.org/wp-content/uploads/2017/01/Description-of-bite-mark-exonerations-and-statistical-analysis_final.pdf) [exonerations-and-statistical-analysis\_final.pdf.](https://www.innocenceproject.org/wp-content/uploads/2017/01/Description-of-bite-mark-exonerations-and-statistical-analysis_final.pdf)

# Bite Mark Evidence is Inadmissible Under *Frye* and Rule 702

Under *Frye,[INSERT JURISDICTION STANDARD] PA Example:* “novel scientific evidence is admissible if the methodology that underlies the evidence has general acceptance in the relevant scientific community.” *Com. v. Walker*, 92 A.3d 766, 789 (Pa. 2014) (internal quotation marks omitted)

The “relevant scientific community” is not limited to proponents of a particular technique. To meet *Frye* and Rule 702,

the expert witness’[s] testimony [must] be based on more than mere personal beliefs or the views of a small segment of the relevant scientific community.

. . . Rather, the testimony must establish that the scientific procedure has gained general acceptance *in the scientific community as a whole* due to its reliability, as evidenced by published scientific studies.

*Com. v. Stringer*, 678 A.2d 1200, 1202 (Pa. Super. Ct. 1996) (internal quotation marks and citation omitted) (emphasis added); *Com. v. Topa*, 369 A.2d 1277, 1282 (Pa. 1977) (rejecting voiceprint analysis because “the reliability of the sound spectrograph and voiceprint identification has not, as yet, been generally accepted *by the scientific community concerned with acoustical science*,” including “speech scientists” (emphasis added)); *Frye*, 293 F. at 1014 (looking to “physiological and psychological authorities,” not merely systolic blood pressure proponents, for general acceptance).[2](#_bookmark1)

2 *See also Reed v. State*, 391 A.2d 364, 377 (Md. 1978) (holding in Frye challenge that there is “no basis for restricting the relevant field of experts to those who have performed voiceprint experiments, and eliminating from consideration the opinions of those scientists in the fields of speech and hearing, as well as related fields, who, by training and education, are competent to make professional judgments concerning experiments undertaken by others. The purpose of the Frye test is defeated by an approach which allows a court to ignore the informed opinions of a substantial segment of the scientific community which stands in opposition to the process in question.” (internal quotation marks omitted)); *State ex rel. Collins v. Superior Court, In & For Maricopa Cty.*, 644 P.2d 1266, 1285 (Ariz. 1982) (*Frye* “[a]cceptance must be by those experts who are relatively disinterested and impartial and whose livelihood, therefore, is not intimately connected with approval of the technique. This requirement is not satisfied with testimony from a single expert or group of experts who personally believe the challenged procedure is accepted or is reliable.” (internal citations omitted)); *Contreras v. State*, 718 P.2d 129, 135 (Alaska 1986) *overruled on other grounds by State v. Coon*, 974 P.2d 386 (Alaska 1999) (adopting *Daubert*) (“We define the relevant scientific community as the academic, scientific, and medical or health-care professions which have studied and/or utilized

The relevant scientific community—unanimous in its rejection of bite mark evidence— in this case is broader than the insular community of practicing forensic dentists. Relevant members of the scientific community who have passed judgment on bite mark evidence—largely since Mr. Doe’s first trial—include:

* + The National Academy of Sciences (“NAS”), an organization made up of the nation’s most accomplished scientists “charged [by an Act of Congress] with providing independent, objective advice to the nation on matters related to science and technology”[3](#_bookmark2)
	+ The Texas Forensic Science Commission, a non-political scientific body with the statutory mandate to, inter alia, asses the “integrity and reliability” of forensic science in Texas[4](#_bookmark3)
	+ The President’s Council of Advisors on Science and Technology (PCAST), an advisory group established by President Dwight D. Eisenhower “of the Nation’s leading scientists and engineers, appointed by the President to augment the science and technology advice available to him from inside the White House and from cabinet departments and other Federal agencies.”[5](#_bookmark4)
	+ A multidisciplinary team of academic and practitioner researchers headed by a forensic dentist who currently serves as one of the 16 members of the National Institute of Standards and Technology’s Scientific Area Committee devoted to Odontology[6](#_bookmark5)
	+ Countless other scientists and scholars, including biologists, physicians, pathologists, forensic practitioners, and statisticians, whose scientific expertise qualifies them to evaluate the validity and reliability of bite mark analysis[7](#_bookmark6)

hypnosis for clinical, therapeutic, research and investigative applications. It does not include those whose involvement with hypnosis is strictly limited to that of practitioner, technician or ‘operator’….”).

3 *See* National Academy of Sciences, available at <http://www.nasonline.org/about-nas/mission/>(last accessed March 4, 2016).

4 *See* Tex. Crim. Proc. Code Ann. § art. 38.01 Sec. 4 (b-1)(1) (empowering the Texas Forensic Science Commission to report on the “observations of the commission regarding the integrity and reliability of the forensic analysis conducted”).

5 *See* Ex. Y at iv (Excerpts from PCAST’s Report to the President: Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods) (“PCAST Report”). The full report is available online at [https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast\_forensic\_science\_report\_fina](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf) [l.pdf.](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf)

6 *See infra* fns. 10-14 (discussing research disproving bite mark analysis); National Institute of Standards and Technology, *OSAC Odontology Subcommittee*, available at <http://www.nist.gov/forensics/osac/sub-odont.cfm> (naming Dr. Mary Bush as a member).

7 *See generally* Ex. B (Amici Curiae Brief of Michael J. Saks, Thomas Albright, Thomas L. Bohan, Barbara E. Bierer and 34 Other Scientists, Statisticians and Law-And-Science Scholars and Practitioners In Support Of the Petition for Writ of Habeas Corpus by William Joseph Richards (“Scientists’ Brief”)). This amicus brief has been

* + Prominent forensic dentists who have rejected the discipline as unreliable[8](#_bookmark7)

“The requirement of general acceptance in the scientific community assures that those most qualified to assess the general validity of a scientific method will have the determinative voice.” *Topa*, 369 A.2d at 1282. These groups, which include some of the nation’s most distinguished scientists with expertise in fields intrinsically relevant to bite mark analysis, are plainly “most qualified” to assess the validity of the scientific methods at issue in this case. Indeed, PCAST specifically defined the relevant scientific community for all feature comparison techniques: “[T]he relevant scientific community for assessing the reliability of feature-comparison sciences includes metrologists (including statisticians) as well other physical and life scientists …**.**

# Importantly, the community is not limited to forensic scientists who practice the specific method” (fn. 90)

1. *Bite Mark Evidence Is Novel Under* Frye

While bite mark evidence is not new, “novelty is not restricted to new science, and even ‘bedrock’ scientific principles may be subject to a *Frye* analysis if those principles become disputed.” *Foley*, 38 A.3d at 888 (internal quotation marks and citation omitted); *see also Betz v. Pneumo Abex, LLC*, 44 A.3d 27, 53 (Pa. 2012) (holding “a reasonably broad meaning should be ascribed to the term ‘novel’”); *Com. v. Safka*, 95 A.3d 304, 308 (Pa. Super. Ct. 2014), *appeal granted in part on other grounds*, 104 A.3d 525 (Pa. 2014) (“If this court assessed ‘novelty’ of scientific evidence based on its previous use in court, we would be failing to defer to scientists in assessing the reliability of scientific methods.” (internal quotation marks omitted)). Rather, novelty should be determined based on whether “there is a legitimate dispute regarding the

subsequently published as a law review article. *See* Michael J. Saks et al.*, Forensic bitemark identification: Weak foundations, exaggerated claims*, 3(3) J. LAW BIOSCI. 1 (2016).

8 *See infra* Part I.2(b) (describing forensic dentists who now recognize the fundamental unreliability of bite marks).

reliability of the expert’s conclusions, which is not necessarily related to the newness of the technology used in developing the conclusions.” *Foley*, 38 A.3d at 888 (internal quotation marks omitted).

Bite marks plainly meet this showing. As Part I.2 *infra* describes, the National Academy of Sciences, the Texas Forensic Science Commission, the President’s Council of Advisors on Science and Technology, and countless scientists and academic researchers, to say nothing of the forensic dentistry community itself, have all rejected bite mark analysis as unreliable as a means for identifying the likelihood that a particular person made a bite mark. *E.g.,* Ex. C at 173 (National Academy of Sciences, Committee on Identifying the Needs of the Forensic Sciences Community, *Strengthening Forensic Science in the United States: a Path Forward* (2009) (“NAS Report”)) (noting that “there is continuing dispute over the value and scientific validity of comparing and identifying bite marks”). Given this complete rejection by every facet of the scientific community, there is thus more than a “legitimate dispute about reliability” for *Frye* purposes.

1. *Bite Marks Are Not Generally Accepted In the Relevant Scientific Community*

Once novelty has been established, *Frye* “require[s] that the proponent of the evidence prove that the methodology an expert used is generally accepted by scientists in the relevant field as a method for arriving at the conclusion the expert will testify to at trial.” *Grady v. Frito-Lay, Inc*., 839 A.2d 1038, 1045 (Pa. 2003). Even if novelty has not been established under *Frye*, the proponent of the evidence must still demonstrate general acceptance as a matter of admissibility under Rule 702.[9](#_bookmark8) Pa.R.E. 702(c) (“A witness who is qualified as an expert by knowledge, skill,

9 To the extent Rule 702 rather than *Frye* per se is the appropriate vehicle for a challenge under the “circumstance[s] of an accepted scientific method losing its widely-held acceptance,” *Com. v. Chmiel*, 30 A.3d 1111, 1142 fn. 13 (Pa. 2011), Mr. Doe challenges the admission of bite mark evidence under both requirements, and the general acceptance inquiry analysis is the same under each standard. *See Grady,* 839 A.2d at 1045 (“[T]he proponent of expert

experience, training, or education may testify in the form of an opinion or otherwise if . . . the expert’s methodology is generally accepted in the relevant field.”). Such a showing is not possible with bite marks. As a group of scientists and scholars have described

[t]he scientific community, and society generally, expect that before being offered to courts, and before courts grant broad and unqualified admission, the claims for a field’s techniques will have been validated. This validation has not happened for bitemark identification.

Ex. B at 44 (Scientists’ Brief) (internal citation omitted). Rather, “[t]here appears to be little, if any, scientifically valid data to support the accuracy of bite mark comparison, and the data that does exist is damning.” *Starks*, 123 F. Supp. 3d at 1051. The complete absence of scientific support for bite marks (and the significant scientific research disproving its underlying assumptions, discussed *infra*) have thus lead to the technique’s rejection as unreliable by virtually every facet of the scientific community.

1. *The assumptions of dental uniqueness and of skin’s ability to record that uniqueness are unreliable and unsupported.*

The rejection of bite marks by the scientific community begins with the fact that bite mark comparison rests on two primary assumptions: one, that the biting surfaces of teeth are measurably distinct (i.e., “uniqueness”) from the teeth of others; and two, that this “uniqueness” or “distinctiveness” can faithfully be recorded in human skin. But these fundamental assumptions are at best baseless speculation and at worst affirmatively shown to be false. To begin, in 2009, the NAS undertook the first examination by an independent scientific body of bite mark evidence and found that neither of these propositions had any basis in science. While this report criticized the scientific foundation for many forensic disciplines, the most pointed and devastating critique was reserved for bite mark evidence. *E.g.,* Ex. C at 175 (scientific research

scientific evidence bears the burden of establishing all of the elements for its admission under Pa.R.E. 702, which includes showing that the *Frye* rule is satisfied.”); *Com. v. Walker*, 92 A.3d at 780.

has not “confirm[ed] the fundamental basis for the science of bite mark comparison”). In particular, the NAS found that

1. The uniqueness of the human dentition has not been scientifically established. [and]
2. The ability of the dentition, if unique, to transfer a unique pattern to human skin and the ability of the skin to maintain that uniqueness has not been scientifically established.

Ex. C at 175 (NAS Report); *see also id.* at 176 (“A standard for the type, quality, and number of individual characteristics required to indicate that a bite mark has reached a threshold of evidentiary value has not been established.”).

But it is not only the NAS that has found these fundamental assumptions wanting. In fact, as to dentition uniqueness, a substantial body of peer-reviewed scientific research largely post-dating the NAS Report demonstrates that not only has this uniqueness *not* been scientifically established, but that it *cannot* be, at least as it relates to the limited features of the teeth likely to be represented in a bite mark (i.e., one narrow surface of less than eight teeth, as opposed to 32 teeth with five sides for a typical adult). These studies repeatedly found significant numbers of random matches between dentitions, even within the limited number of samples included in the studies. These findings demonstrate that the biting surfaces of many people’s teeth are not measurably distinct from others.[10](#_bookmark9) A group of scientists and scholars reviewing this work have concluded that “[t]hese findings bring the notion of dental uniqueness,

10 *See* Ex. D (Mary A. Bush, Peter J. Bush & H. David Sheets, *Statistical Evidence for the Similarity of the Human Dentition*, 56 J. FORENSIC SCI. 118 (2011) (finding tooth positions are correlated and non-uniform; observing matches)); Ex. E (H. David Sheets et al., *Dental Shape Match Rates in Selected and Orthodontically Treated Populations in New York State: A Two Dimensional Study*, 56 J. FORENSIC SCI. 621 (2011) (finding an increase of match rates from 1.46% to 42.7% between an orthodontically treated population and a non-orthodontically treated population)); Ex. F (Mary A. Bush, Peter J. Bush & H. David Sheets, *Similarity and Match Rates of the Human Dentition In 3 Dimensions: Relevance to Bitemark Analysis*, 125 INT. J. LEG. MED. 779 (2011) (finding dentition matches in two- and three-dimensional study)); Ex. G (H. David Sheets et al*.*, *Patterns of Variation and Match Rates of the Anterior Biting Dentition: Characteristics of a Database of 3D-Scanned Dentitions*, 58 J. FORENSIC SCI. 60 (2013) (finding dentition matches in study using size and shape)).

central to bitemark analysis, into considerable doubt. As the assumption of uniqueness fades away, so does the claim that bitemark comparison can dependably link a bitemark to its source.” Ex. B at 28 (Scientists’ Brief).

The assumption that human skin is capable of accurately capturing dentition uniqueness has fared no better when put to the test by science. As the NAS explained, “bite marks on the skin will change over time and can be distorted by the elasticity of the skin, the unevenness of the surface bite, and swelling and healing. These features *may severely limit the validity of forensic odontology*.” Ex. C at 174 (NAS Report) (emphasis added); *see also id.* at 175 (finding “[t]he ability to analyze and interpret the scope or extent of distortion of bite mark patterns on human skin has not been demonstrated”); *id.* (“[T]he effect of distortion on different comparison techniques is not fully understood and therefore has not been quantified.”).

Moreover, as with the supposed uniqueness of the dentition, a new body of science— much of which emerged after publication of the NAS Report—demonstrates that due to its anisotropic, viscoelastic, and non-linear properties, human skin cannot accurately record whatever measurably distinct features may be present in the human dentition.[11](#_bookmark10) These published, peer-reviewed studies have now demonstrated that skin’s natural tension lines and tissue movement distort bite marks, often dramatically.[12](#_bookmark11) Moreover, bite marks from the same dentition may appear substantially different depending on the angle and movement of the body

11 Ex. H (Mary A. Bush et al., *A Study of Multiple Bitemarks Inflicted in Human Skin by a Single Dentition Using Geometric Morphometric Analysis*, 211 FORENSIC SCI. INT. 1 (2011) (bite marks in skin from a single dentition were substantially different than dentition that produced it; marks matched multiple specimens)); Ex. I (Mary A. Bush et al., *The Response of Skin to Applied Stress: Investigation of Bitemark Distortion in a Cadaver Model*, 55 J. FORENSIC SCI. 71 (2010) (bite force variation created unpredictable skin damage)); Ex. J (Mary A. Bush et al., *Inquiry into the Scientific Basis For Bitemark Profiling and Arbitrary Distortion Compensation*, 55 J. FORENSIC SCI. 976 (2010) (same)); Ex. K (Raymond G. Miller et al., *Uniqueness of the Dentition as Impressed in Human Skin: A Cadaver Model*, 54 J. FORENSIC SCI. 909 (2009) (finding some dentitions were closer matches within measurement error to marks they did not make than the dentition that actually created the marks) (“Miller, Uniqueness”)).

12 *E.g.*, Ex. L ( Mary A. Bush et al., *Biomechanical Factors in Human Dermal Bitemarks in a Cadaver Model*, 54 J. FORENSIC SCI. 167 (2009) (same dentition can create significantly different marks depending on body’s movement, angle, and location relevant to Langer lines)).

and whether the mark was made parallel or perpendicular to tension, or Langer, lines.[13](#_bookmark12) Indeed, skin is so unreliable as a medium that similarly aligned dentitions may create marks *indistinguishable* from one another. Even more concerning in the criminal context, this research also revealed that dentitions may appear to best match marks *they did not create*.[14](#_bookmark13) These studies clearly show that “pliability, elasticity and reactivity of skin and flesh all create a major challenge for bitemark identification and set it apart from other kinds of pattern-comparison forensic identification.” Ex. B at 20 (Scientists’ Brief). Thus, even if the dentition were unique, bite mark analysis would still fail, because human skin simply cannot accurately reflect that uniqueness.

Unsurprisingly, given the devastating critiques from the NAS and subsequent academic research, the Texas Forensic Science Commission (“TFSC” or “Commission”) has also rejected bite marks as unreliable, following a six-month investigation into the validity and reliability of bite mark evidence. The TFSC’s inquiry, sparked by yet another wrongful bite mark conviction, involved extensive literatures reviews and the taking of substantial testimony from forensic odontologists and scientists. *See generally* Ex. R (Transcript of the Nov. 16, 2015, Bite Mark Panel meeting of the Texas Forensic Science Commission (“TFSC Tr.”)) (inter alia, testimony of Dr. Iain Pretty, Dr. Adam Freeman, Peter Bush); *id.* at 276 (noting the job of the bite mark committee is to report on the “integrity and reliability” of bite marks). As a result of this investigation, in April 2016 the TFSC adopted the recommendation of its bite mark committee,[15](#_bookmark14) who concluded that “the overwhelming majority of existing research does not support the

13 *Id.*

14*E.g.,* Ex. J (Miller, Uniqueness). For a real life example of how well an innocent person’s dentition can appear to match a bite mark, *see* Ex. B at 46 (Scientists’ Brief) (picture of exoneree Ray Krone’s dentition against the bite mark DNA evidence proved he did not make).

15 To the extent that the Commonwealth argues that the TFSC review excluded the views of forensic practitioners, it is worth noting that the bite mark panel both heard extensive testimony from bite mark analysts and itself included oral pathologist, a medical examiner, and a forensic scientist. *See* Texas Forensic Science Commission, Texas Bite Mark Case Review Panel, available at <http://www.fsc.texas.gov/texas-bite-mark-case-review>

contention that bitemark comparison can be performed reliably and accurately from examiner to examiner due to the subjective nature of the analysis.” Ex. Z at 12 (Texas Forensic Science Commission, *Forensic Bitemark Comparioson Complaint Filed by National Innocence Project on Behalf of Steven Mark Chaney- Final Report, Finalized at Quarterly Meeting, April 12, 2016* (“TFSC Report”)). Ultimately, the TFSC “recommend[ed] that bitemark comparison not be admitted in criminal cases in Texas unless and until” foundational research to validate bite marks was done. *Id*. at 15. [16](#_bookmark15) As Dr. Vincent Di Maio, the forensic pathologist who chaired the Commission’s bite marks panel stated, “‘We concluded that bite marks should not be admitted in criminal cases at this point . . . . We feel it does not meet the standards of forensic science.’” Ex. S (Eckholm, Texas). The Commission is also undertaking a review of all convictions obtained through bite mark evidence in Texas. Ex. Z at 15 (TFSC Report).[17](#_bookmark16)

Later in 2016, PCAST conducted another investigation of bite mark evidence, along with several other forensic disciplines. Like virtually every independent scientist and scientific body before it, PCAST found that bite mark evidence is “clearly scientifically unreliable” at present and that “bitemark analysis does not meet the scientific standards for foundational validity, and is far from meeting such standards.” Ex. Y at 87 (PCAST Report). PCAST’s standards for

16 *See also* Ex. S (Erik Eckholm, *Texas Panel Calls for an End to Criminal IDs via Bite Mark,* N.Y. TIMES, Feb. 12, 2016, at A10 (“Eckholm, Texas”)) (Reporting that the TFSC “called . . . for a halt in the use of bite-mark identifications in criminal trials, concluding that the validity of the technique has not been scientifically established.”); Ex. T (Joe Palazzolo, *Texas Commission Recommends Ban on Bite-Mark Evidence*, WALL ST. J., Feb. 12, 2016) (“A Texas commission recommended on Friday that the state suspend the use of bite-mark evidence in criminal cases pending additional research, becoming the first agency in the nation to discredit a forensic technique that has come under intense scrutiny in recent years.”), S*ee also* Jon Herskovitz, *Influential Texas Panel Recommends Halt to Use of Bite-Mark Evidence,* Reuters, Feb. 11, 2016, available at <http://www.reuters.com/article/us-texas-bitemark-idUSKCN0VL001>(discussing panel recommendation to full Commission).

17 *See also* Ex. U (Allan Turner, *Forensic Science Commission Urges Moratorium On "Bite Mark" Evidence In Texas Trial: Commission Deems It Flawed As Evidence*, HOUSTON CHRONICLE, Feb. 12, 2016) (“[T]he Texas Forensic Science Commission on Friday asked Texas judges to institute a moratorium on the use of questionable ‘bite mark’ evidence in criminal cases. Noting that such analysis currently is not adequately supported by science, a commission subcommittee also authorized a review of previous convictions in which bite mark testimony played a part.”).

foundational validity are, simply, that “empirical studies” demonstrate that a technique is “repeatable, reproducible, and accurate, at levels that have been measured and are appropriate to the intended application”—in other words, that it is reliable. *Id.* at 4. PCAST determined that the flaws with bite mark evidence go to its very foundation, finding that what little research has been done “cast[s] serious doubt on the fundamental premises of the field. To the contrary,

available scientific evidence strongly suggests that examiners cannot consistently agree on whether an injury is a human bitemark and cannot identify the source of bitemark with reasonable accuracy.” *Id.* at 87. including the distinctiveness of the dentition and the ability of the human skin to reliably record that distinctiveness. *Id.* at 83. Notably, PCAST found that random dentition “matches occurred vastly more often than expected under the theoretical model,” and, most critically (*see infra*), that “skin has been shown to be an *unreliable medium* for recording the precise pattern of teeth.” *Id*. at 84 (emphasis added). For PCAST, the fundamental flaws involved in bite mark analysis were so egregious that it “considers the prospects of developing bitemark analysis into a scientifically valid method to be low” “and advise[s] against devoting significant resources to such efforts.” *Id.* at 87.

Following the release of the PCAST report, some stakeholders criticized PCAST for allegedly ignoring certain scholarship offering support for the foundational validity of bite mark analysis. In response, on December 2, 2016, an email was sent to the entire membership of the American Academy of Forensic Sciences (“AAFS”) from Dr. Lander asking that practitioners “identify any relevant scientific reports that (i) have been published in the scientific literature,

1. were not mentioned in the PCAST report; and (iii) describe appropriately designed, research studies that provide empirical evidence establishing the foundational validity and estimating the accuracy of any of,” inter alia, bite marks, and to “indicate how the scientific reports establish

foundational validity and estimate the accuracy of the relevant method.” Ex. AA (Email from Dr. Eric Lander to American Academy of Forensic Sciences Membership, dated December 2, 2016). On January 6, 2017, PCAST supplemented its report based on responses from the forensic community. Ex. BB at 2-3 (President’s Council of Advisors on Science and Technology, *An Addendum to the PCAST Report On Forensic Science In Criminal Courts*, January 2017 (“PCAST Addendum”)). This addendum demonstrates the complete lack of merit to the criticism of the bodies described by the Commonwealth. For example, though the DOJ critiqued PCAST for failing to “mention numerous published research studies which seem to meet PCAST’s criteria for appropriately designed studies providing support for foundational validity,” *id.* at 2, when called upon to provide those studies to PCAST, “DOJ ultimately concluded that it had no additional studies for PCAST to consider.” *Id.* at 3. As to bite marks in particular, PCAST wrote that

[i]n its report, [it] stated that it found no empirical studies whatsoever that establish the scientific validity or degree of reliability of bitemark analysis as currently practiced. To the contrary, it found considerable literature pointing to the unreliability of the method. None of the respondents identified any empirical studies that establish the validity or reliability of bitemark analysis. (One respondent noted a paper, which had already been reviewed by PCAST, that studied whether examiners agree when measuring features in dental casts but did not study bitemarks.) One respondent shared a recent paper by a distinguished group of biomedical scientists, forensic scientists, statisticians, pathologists, medical examiners, lawyers, and others, published in November 2016, that is highly critical of bitemark analysis and is consistent with PCAST’s analysis.

*Id.* at 5. With these conclusions, PCAST joins the long litany of scientists and scientific institutions that have thoroughly examined bite mark evidence and its support and found it to be unreliable.

1. *Forensic odontologists cannot reliably associate a dentition with a bite mark.*

Given that both of its fundamental assumptions are disproved, it is a foregone conclusion that the scientific community has also found that forensic dentists cannot reliably associate a

dentition with a bite mark. As an initial matter, “error rates by forensic dentists are perhaps the highest of any forensic identification specialty still being practiced.” Ex. B at 5 (Scientists’ Brief). Research by forensic dentists themselves demonstrates the profound unreliability that pervades bite mark analysis at even the most basic levels. One recent study conducted by the current President of the American Board of Forensic Odontology (“ABFO”), forensic odontology’s only board-certifying body, along with another forensic odontologist, demonstrates that even the most experienced forensic odontologists cannot agree on whether an injury is a bite mark *at all*, to say nothing of whether it was caused by a particular individual.

As part of this study, entitled *Construct Validity Bitemark Assessments Using the ABFO Bitemark Decision Tree* (“Construct Validity Study”), photographs of 100 patterned injuries were shown to 103 ABFO board-certified Diplomates.[18](#_bookmark17) They were asked to decide three questions: first, whether there was sufficient evidence to render an opinion on whether the patterned injury was a human bite mark; second, whether, consistent with the ABFO decision tree, the injury could be determined to be either a human bite mark, not a human bite mark, or suggestive of a human bite mark (the three options the ABFO’s guidelines then provided); and third, if a human bite mark, whether it had distinct, identifiable arches and individual tooth marks. *See* Ex. M (Radley Balko, *A Bite Mark Matching Advocacy Group Just Conducted A Study That Discredits Bite Mark Evidence*, WASHINGTON POST, April 8, 2015 (“Balko, Advocacy”)). Thirty-nine diplomates—accounting for nearly 40% of practicing ABFO diplomates—finished all 100 questions, resulting in nearly 4,000 decisions. Drs. Iain Pretty and Adam Freeman, the forensic odontologists who conducted the Construct Validity Study, did not examine the results for ground truth—i.e., whether the diplomates accurately determined what

18 While this motion demonstrates that no person—whether board-certified or not—can reliably associate a dentition with a bite mark, it bears note that if the Commonwealth proposes to advance Dr. Asen again, he does not even meet this minimal qualification of belonging to the ABFO. Ex. A at 32-33 (Asen Testimony).

type of injury they were looking at—but rather, on an even more basic level, whether the diplomates agreed with one another. The results were shockingly poor. Determinations were wildly inconsistent across forensic odontologists on the vast majority of marks. As *The Washington Post* reported, on the question of whether the injury provided sufficient information from which to make a determination as to origin—“the most basic question a bite mark specialist should answer before performing an analysis”—

the 39 analysts came to unanimous agreement on just 4 of the 100 case studies. In only 20 of the 100 was there agreement of 90 percent or more on this question. By the time the analysts finished question two — whether the photographed mark is indeed a human bite — there remained only 16 of 100 cases in which 90 percent or more of the analysts were still in agreement. And there were only 38 cases in which at least 75 percent were still in agreement. . .

. By the time the analysts finished question three, they were significantly fractionalized on nearly all the cases. Of the initial 100, there remained just 8 case studies in which at least 90 percent of the analysts were still in agreement.

*Id.* These failures are deeply disturbing. As a group of distinguished scientists reviewing the study’s results concluded, “if dental examiners cannot agree on whether or not there is enough information in an injury to determine whether it is a bitemark, and cannot agree on whether or not a wound is a bitemark, then there is nothing more they can be relied upon to say.” Ex. B at 34 (Scientists’ Brief); *see also* Ex. C at 176 (NAS Report) (“[A] standard for the type, quality, and number of individual characteristics required to indicate that a bite mark has reached a threshold of evidentiary value has not been established.”).[19](#_bookmark18)

Given the lack of a scientific basis for bite mark comparison evidence, the Construct Validity Study’s results are hardly surprising. Nor are they anomalous: a study published in the May 2013 *Journal of Forensic Sciences* largely presaged its findings. *See* Ex. N (Mark Page, et

19 The study results were so devastating that they prompted one federal official to call for the eradication of bite mark evidence. Radley Balko, *A High-Ranking Obama Official Just Called For The “Eradication” Of Bite Mark Evidence*, WASHINGTON POST, July 22, 2015, available at https://[www.washingtonpost.com/news/the-](http://www.washingtonpost.com/news/the-) watch/wp/2015/07/22/a-high-ranking-obama-official-just-called-for-the-eradication-of-bite-mark-evidence/.

al., *Expert Interpretation of Bitemark Injuries—A Contemporary Study*, 58(3) J. FORENSIC SCI. 664 (May 2013)). As that study noted, “[w]hile most odontologists would suggest they can determine with a reasonable degree of certainty what is and what is not a bitemark, there is little evidence to support this claim.” *Id.* at 664 Looking to close this gap, researchers asked fifteen Australian forensic odontologists—who comprised the majority of those practicing forensic odontology in Australia—to examine six images of potential bite marks, five of which were of marks confirmed by living victims to have been caused by teeth. *Id.* at 665. The odontologists were then asked in narrative form whether the injuries were, in fact, bite marks. As with the Construct Validity Study, “conclusions between practitioners [were] highly variable.” *Id.* at 671. Thus, “the qualitative data plainly verifie[d] the fact that there is a wide range of opinion expressed over even the most basic assumption in bitemark analysis: that of the origin of the mark itself.” *Id.*. The study further concluded that this “inconsistency indicates a fundamental flaw in the methodology of bitemark analysis and should lead to concerns regarding the reliability of any conclusions reached about matching such a bitemark to a dentition.” *Id.* at 670.

The inability of bite mark analysts to properly identify human bite marks as such in the first instance is only compounded when they are asked to make conclusions regarding the perpetrator. Study after study has demonstrated a “disturbingly high false-positive error rate” in bite mark comparisons. *See* Ex. O at S107 (C. Michael Bowers, Problem-Based Analysis of Bitemark Misidentifications: The Role of DNA, 159S FORENSIC SCI. INT'L S104 (2006)). For example, a 2006 review written by a forensic odontologist detailed the following findings:

* + a 1975 study found that bite mark examiners made “[i]ncorrect identification[s] of . . . bites” on pig skin 24% of the time even when the bites were made “under ideal laboratory conditions” and 91% of the time when the bites were photographed 24 hours after being made;
	+ a 1999 American Board of Forensic Odontology Bitemark Workshop in which “ABFO diplomats attempted to match four bitemarks to seven dental models” resulted in 63.5% false positives;
	+ a 2001 study of “bites made in pig skin” resulted in between 11.9 and 22.0% “false positive identifications . . . for various groups of forensic odontologists.”

*Id*. at S106. Nor have errors been limited to the lab; at least 27 people have been wrongfully convicted or indicted on the basis of bite mark evidence. *See* Ex. P (Amanda Lee Myers, *Bites Derided as Unreliable in Court*, ASSOCIATED PRESS, June 16, 2013, available at [http://bigstory.ap.org/article/ap-impact-bites-derided-](http://bigstory.ap.org/article/ap-impact-bites-derided-unreliable-court)

[unreliable-court](http://bigstory.ap.org/article/ap-impact-bites-derided-unreliable-court)); Ex. Q (Innocence Project, *List of Wrongful Bite Mark Convictions*

*and Indictments*). These error rates and the attendant wrongful convictions put beyond dispute the fact that bite mark comparison is inherently unreliable.

Through its assessment of whether bite mark analysis is foundationally valid, PCAST expressed concern that “[e]mpirical research suggests that forensic odontologists do not consistently agree even on whether an injury is a human bitemark at all.” *Id.* at 84. In other words, reliable scientific evidence demonstrates that forensic dentists, like Dr. Asen, cannot even tell whether something is even a bite mark, to say nothing of who might have inflicted it. On that point, PCAST found that while there are “[f]ew empirical studies . . . study[ing] the ability of examiners to accurately identify the source of a bitemark,” of those that have been done, “the observed false positive rates were so high that the method is clearly scientifically unreliable at present.” *Id*. at 87.

1. *The scientific community has rejected bite mark analysis as unreliable.*

As the foregoing demonstrates, bite mark evidence has no scientific support whatsoever, and what science there is disproves it. Indeed, forensic odontology’s own practitioners and own studies have repeatedly proved that bite mark evidence is completely unreliable. It is no surprise, then, that the scientific community, however it is defined, has rejected bite mark evidence as unreliable. At the broadest levels, the NAS has concluded that “[t]he scientific basis is *insufficient to conclude that bite mark comparisons can result in a conclusive match*.” Ex. C at 175 (NAS Report) (emphasis added); *id*. at 7 (forensic odontologists lack “the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source”); *id.* at 174 (“[t]here is no science on the reproducibility of the different methods of analysis that lead to conclusions about the probability of a match. This includes reproducibility between experts and with the same expert over time.”).

The conclusion of the “respected and non-ideological” TFSC further proves thast the view of the larger scientific community that bite marks do not, in the words of Dr. Di Maio, “meet the standards of forensic science”—in other words, that bite mark evidence is no longer generally accepted as reliable. Ex. S (Eckholm, Texas) The Commission’s findings also speak to the more narrow scientific community, as its determination rested in large part on evidence from forensic odontologists themselves, whose testimony before the Commission supported the view that bite mark evidence is currently without a scientific basis. *See* Ex. S (Eckholm, Texas) (“In one study presented to the Texas commission, a panel of leading forensic dentists studied photographs of purported bite wounds and in most cases could not even agree whether the marks were caused by human teeth.”).

In fact, the authors of the Construct Validity Study discussed *supra* (both practicing forensic odontologists)*,* gave substantial testimony before the TFSC regarding the fundamental

unreliability of bite mark evidence. Dr. Pretty testified that his “data speak for themselves in terms of the incredible lack of reliability in stating whether or not injuries are bitemarks,” Ex. R at 145 (TFSC Tr.), and, as he further testified, a technique “cannot be valid unless it’s reliable,” *id.* at 140.[20](#_bookmark19) Dr. Pretty concluded that “[t]he study suggests that the level of reliability of injury assessment for bitemarks is not currently satisfactory from the population of those that were studied,” *Id.* at 150— a population that constituted over 40% of the ABFO’s active membership.[21](#_bookmark20) For his part, Dr. Freeman, currently the President of the ABFO, testified that in his and Dr. Pretty’s view, the results of the Construct Validity Study at a minimum show that “[a] link to a suspected biter to the exclusion of all others” or, indeed, “*any* form of positive” linkage, “even using the term, ‘probable linkage’ is inappropriate,” and “not safe . . . due to the risk of false positive being too high.” *Id.* at 157 (emphasis added).

Drs. Pretty and Freeman are far from the only forensic odontologists who have come to recognize the fundamental unreliability of their discipline. In October 2015, in Fayette County, Pennsylvania, Judge John F. Wagner overturned the 2006 homicide conviction of Crystal Weimer. Ms Weimer was convicted in part through the use of bite mark evidence. The forensic odontologist, Dr. Constantine Karazulas, who originally matched Ms. Weimer to a bite mark, testified in a hearing that after “reviewing the [NAS] report and doing additional analysis,” he had come to the conclusion that bite mark evidence was “junk science.” Ex. V at 13-14, 21 (Transcript of Post-Conviction Relief Act Proceedings, *Commonwealth of Pennsylvania v.*

*Crystal Dawn Weimer* (“Weimer Transcript”)). As Dr. Karazulas, who was the chief forensic

20 *See also id.* at 146 (Dr. Pretty: data “[s]till doesn’t tell a very good picture about the reliability. . . all we’re asking here is: Is this a human bitemark?”); *id.* at 148 (Dr. Pretty: results of the study are “deeply worrying”); *id.* at 151 (Dr. Pretty: “I think if you remove those suggestive’s—so pretend to just take them off and put them into insufficient evidence, [the study] still [does] not paint a hugely encouraging picture of our ability, as forensic dentists, to say whether or not an injury is a bitemark or not”).

21 *See* American Board Of Forensic Odontology Diplomate Information: Updated 9/29/2015, available at <http://www.abfo.org/wp-content/uploads/2013/02/ABFO-Diplomate-Information-revised-9-29-2015.pdf>(listing 95 active members).

odontologist for the Connecticut Crime Laboratory for decades, testified, “[t]here is no science in bite mark evidence . . . .” *Id.* at 19. After hearing this testimony, the judge ruled from the bench that Ms. Weimer was entitled to a new trial. *Id.* at 22-23.[22](#_bookmark21)

Other high-profile forensic dentists have also come to reject bite mark evidence as unreliable. For example, one of the foremost public advocates of bite mark evidence, Dr. Michael West—a forensic dentist who testified in that bite marks found on victims matched the dentition of particular suspects at least thirty-eight trials (including some that resulted in later exonerations based on DNA evidence)—has renounced his prior position and has explained that he now considers bite mark evidence to be unreliable. Specifically, Dr. West testified in a sworn deposition that “I no longer believe in bite-mark analysis. I don't think it should be used in court. I think you should use DNA. Throw bite marks out.” *See* Ex. W (Jerry Mitchell, *Bite Mark Expert Dismisses Own Testimony*, CLARION LEDGER, June 20, 2015). Dr. West’s renunciation is echoed by forensic odontologist Dr. Michael Bowers, who has noted that “human skin is incapable of consistently being referenced to a known biter’s dentition . . . and that dental uniqueness assumptions are not supported.”[23](#_bookmark22) Drs. West, Bowers, Karazulas, Freeman, and Pretty’s repudiation of individualization and probabilistic conclusions in bite marks comports with the findings of the broader scientific community, as presented by the NAS Report and the TFSC, that bite mark evidence has not been shown to be reliable.

Even the ABFO itself, presumably the largest supporter of bite mark comparison evidence, has come to recognize the inherent weakness in the field. In early 2016, the ABFO substantially limited their Guidelines; today, the only sanctioned conclusions by the ABFO are

22 Judge Wagner later dismissed all charges against Ms. Weimer. *Judge dismisses charges in woman’s bite-mark conviction*, ASSOCIATED PRESS, June 28, 2016, available at [https://apnews.com/cf0b9e93f5434b2e9b356a107ade183b/judge-dismisses-charges-womans-bite-mark-conviction.](https://apnews.com/cf0b9e93f5434b2e9b356a107ade183b/judge-dismisses-charges-womans-bite-mark-conviction)  23 C. Michael Bowers, Forensic Dental Evidence: An Investigator's Handbook 150 (2d ed. 2011).

that a person may be included or excluded as a potential biter, or that there is not enough information to draw any conclusion.[24](#_bookmark23) Of course, these conclusions, no less than any others previously offered, are entirely unsupported by science; as the substantial research detailed *supra* shows, the lack of distinctness in the dentition and, most importantly, the distortion inherent in human skin, means that dentists cannot reliably include or exclude a biter. Indeed, as the Construct Validity Study shows, they cannot even reliably identify an injury as a bite mark in the first instance. These changes are nonetheless significant as reflective of the recognition within the narrow community of odontologists that bite mark matching is, at its core, unreliable.

This shift in the scientific community has not gone unrecognized by courts. In Oct. 2015, a Texas court freed a man who had been imprisoned for nearly 30 years on the basis of bite mark evidence based on that state’s “junk science statute,” which permits post-conviction relief where science relied upon by the state at trial changes after conviction. *See generally See* Ex. X at ¶¶

14-15 (*Ex Parte Steven Mark Chaney,* Agreed Findings of Fact and Conclusions of Law on Applicant’s Subsequent Writ of Habeas Corpus, Dist. Ct. 4, Dallas Cty. Tx. (Oct. 12, 2005) (“Chaney Findings”)). The Court found Mr. Chaney was entitled to relief in part because the testimony offered at trial matching him to the bite mark could not today be offered. *Id.* at ¶¶ 22-

30. Also in Texas, two judges on the Texas Court of Criminal Appeals, that state’s highest criminal appellate court, have also explicitly recognized that bite mark comparison evidence is insufficiently reliable to be used in criminal trials in decisions examining Texas’s junk science statute. *See Ex Parte Robbins,* No. WR-73,484-02, 2014 WL 6751684, at \*15-16 and fn. 28

24 The change in the Guidelines was announced by the ABFO at the 2016 American Academy of Forensic Science Annual Meeting, which took place from February 22nd- 27th. The most recent version of the ABFO Diplomates Reference Manual, as updated in April 2017 without changes to the bite mark guidelines, is available at [http://abfo.org/wp-content/uploads/2012/08/ABFO-Reference-Manual-April-2017-v7.pdf.](http://abfo.org/wp-content/uploads/2012/08/ABFO-Reference-Manual-April-2017-v7.pdf)

(Tex. Crim. App. Nov. 26, 2014) (Cochran, J., concurring) (describing forensic odontology as “insufficiently reliable” and noting that an “expert state[ment] that the bitemark on the victim was made by the defendant when there is no empirical data to support such a finding” is a type of “‘over-claiming’ or scientific puffery”); *id.* at \*13 (Johnson, J., concurring) (finding that “some examples of ‘contradicted scientific evidence relied on by the state at trial’ include arson, infant trauma, bullet-lead analysis, bite marks, some ballistics tests, blood-spatter patterns, and scent line-ups.”).

In another recent case, a federal judge denied relief to a plaintiff who brought a civil suit against the forensic dentists whose bite mark matching testimony wrongly convicted him—not because bite mark evidence is valid and reliable, but because it is *so* bad that complaining about how it was undertaken “would be akin to saying that an astrologer ‘falsified’ his conclusion that, because the planets are in a particular alignment, the defendant must have committed the crime, or to complain that a palm reader grossly deviated from professional standards by mistaking the heart line for the head line.” *Starks*, 2015 WL 5012131 at \*16. Citing the research on the lack of dentition uniqueness and of skin’s unreliability as a recording medium, the NAS Report, and the high error rates all described *supra*, the Court also found it “doubtful that ‘expert’ bite mark analysis would pass muster under Federal Rule of Evidence 702 in a case tried in federal court.” *Id.* at \*13 (citing Fed.R.Evid. 702(c), which requires that expert testimony be “the product of reliable principles and methods”)); *id.* at \*12 (finding there is “little, if any, scientifically valid data to support the accuracy of bite mark comparison, and the data that does exist is damning”). Equally important, the court rejected the testimony of the forensic dentist who continued to support the discipline as being motivated not by science, but by his financial interest in the continuation of the discipline, *id.* at \*13, a finding which speaks to the need to construe the

scientific community beyond the practitioners of the technique at issue. Ultimately, these decisions reflect an increasing willingness by courts to acknowledge what the scientific community already has—that bite mark comparison evidence has no basis in science and no place in our courts. *See also Ege v. Yukins*, 485 F.3d 364, 376 (6th Cir. 2007) (finding “[b]ite mark evidence may by its very nature be overly prejudicial and unreliable,” and granting habeas relief because trial counsel was ineffective for not objecting under *Frye* to its introduction).

Finally, the Commonwealth’s argument that this court should admit the evidence because forensic dentists (and the few remaining proponents of bite marks) say so is completely without merit. As PCAST succinctly put it, “[t]he fact that bitemark examiners defend the validity of bitemark examination means little.” Ex. Y at 55 (PCAST Report). Of course, people like Dr.

Asen, who make their living in part on bite mark analysis, think that their methodologies are good ones. That does not mean that the methodologies they employ are valid or reliable, nor does it mean that scientists accept them as such. In fact, the significant evidence adduced by Mr. Doe shows that as to bite marks, scientists whose livelihood and reputations are not intimately bound up in the continued practice of bite mark analysis, and whose work plainly bears on that technique’s reliability, have found it to be completely unreliable. The disagreement by bite mark “experts” with this conclusion is of no moment. As one federal court examining bite marks observed, quoting Upton Sinclair, “[i]t is difficult to get a man to understand something, when his salary depends upon his not understanding it!” *Starks v. City of Waukegan*, 123 F. Supp. 3d 1036, 1052 (N.D. Ill. 2015) (comparing bite marks’ reliability to that of astrology and palm reading). To admit bite mark evidence when all disinterested scientists reject it would be a perverse reading of *Frye* indeed, as well as a serious deprivation of Mr. Doe’s constitutional rights.

One of the major threads in the Commonwealth’s briefing is the notion that Mr. Doe’s authorities should be ignored because they are not made up of forensic scientists. Not only is this argument misplaced, but it is also largely untrue. For example, the Commonwealth suggests that the NAS Report has no value because the “committee consisted of numerous academics and statisticians ” Commonwealth’s Brief in Response to the Innocence Project’s Second

Supplemental Motion (“Second Opposition”) at 1. But this denigration of the NAS’s makeup, and the implication that the body was completely divorced from forensic science practitioners, is false. In fact,

[s]even of the 17 [NAS] Committee members are prominent professionals in the forensic science community, with extensive experience in forensic analysis and practice; 11 members of the Committee are trained scientists (with expertise in physics, chemistry, biology, engineering, biostatistics, statistics, and medicine); 10 members of the Committee have Ph.Ds, 2 have MDs, 5 have JDs, and one has an M.S. in chemistry.

Ex. CC at 1 (Hon. Harry T. Edwards, *The National Academy of Sciences Report on Forensic Sciences: What it Means for the Bench and Bar*, Presentation at the Superior Court of the District of Columbia (May 6, 2010) (“Edwards Presentation”)). Likewise, the Texas Forensic Science Commission, at the time of its bite mark review and report, included three forensic pathologists, a forensic geneticist, a forensic biologist with a degree in human anatomy, and a forensic toxicologist, as well as an oral pathologist, a prosecutor, and a defense attorney.[25](#_bookmark24) Plainly, forensic scientists, as well as those who work in other fields, have carefully considered and rejected bite mark analysis.

Indeed, the vociferous defense of bite mark analysis by those most invested in its continued use—i.e., prosecutors and bite mark analysts themselves—speaks to the continued suppression of scientific research and dissent within the forensic science community rather than

25 *See* Ex. EE (Texas Forensic Science Commission, *Commission Members* (Feb. 26, 2016)).

to existence of any evidence supporting the discipline. A series of articles published earlier this year by the Washington Post revealed the ABFO’s longstanding pattern and practice of suppressing dissent and punishing scrutiny. The articles reveal that most recently, the ABFO sought to silence one of its most prominent critics, Dr. Michael Bowers, by filing a retaliatory ethics complaint against him in front of the American Academy of Forensic Sciences (“AAFS”). *See* Ex. DD (Radley Balko, *Attack Of The Bite Mark Matchers*, WASHINGTON POST, Feb. 18, 2015 (“Balko, Attack”). The Washington Post’s reporting revealed that the ABFO President, Peter Loomis, filed the ethics complaint two weeks after Dr. Bowers published a book especially critical of bite mark evidence and one month after the high-profile bite mark exoneration, discussed below, of Gerard Richardson. *Id.* As the Post reported, “[t]he complaint also came as Bowers has been preparing to testify as an expert witness in two lawsuits against bite mark analysts brought by people who had been convicted by bite mark testimony and were exonerated after serving long terms in prison.” *Id.*

This “transparent attempt to purge someone who has been a problem for [the ABFO]” continued into the ethics hearing. There, it was revealed that an ABFO executive committee member, Paula Brumit, who was also on the ethics committee hearing the complaint against Dr. Bowers, had actually met with Dr. Loomis the night before and prepared him for his testimony. Perhaps seeing the complaint for what it was, the board of the AAFS ultimately declined to sustain the charges against Dr. Bowers. *Id.*

In addition to this campaign to drum out a powerful critic, the Washington Post stories also reflect efforts by the ABFO and by a New York County ADA to silence Dr. Mary and Peter Bush. The Washington Post reveals that the Bushes’ research on the fundamental assumptions of bite mark analysis was welcomed and supported by the ABFO until they “began to come back

with results that called the entire discipline into question. . . .” *Id*. Once the Bushes’ results made plain that there is no scientific basis for bite mark comparisons, the forensic dentistry community undertook “a nasty campaign to undermine [their] credibility.” *Id.* That campaign included support from an ADA trying a case in which Dr. Bush was a witness for the defense, who—despite the pendency of that case— “heckled the Bushes during a [February 2013] panel in which they tried to explain their research. According to those in attendance, she brought a printout of Mary Bush’s testimony from the Dean case and essentially tried to continue her cross-examination in a public forum.” *Id.*

That prosecutor continued her crusade during a “basically a no-holds-barred attack” on Dr. Bush during an ABFO dinner held at the 2014 AAFS Meeting. Her speech was described by attendees as “‘malicious,’ ‘bullying’ and ‘degrading.’” *Id.* Such public behavior during a pending criminal matter is not only unethical (*see* N.Y. Rule of Prof. Conduct 3.6), but also clearly reflects the suppression of dissent—indeed, of real science—by the bite mark community facilitated by the prosecuting attorney in the instant matter.

The ABFO’s campaign to silence dissent and suppress data is not limited to its efforts to discredit Drs. Bowers and Bush. When Drs. Pretty and Freeman were questioned at the TFSC meeting on November 16, 2015, about why the results of the Construct Validity Study had not yet been published in peer-reviewed journal given their significance, Dr. Freeman stated that he and Dr. Pretty had been subjected to “vitriol,” “personal attacks,” and threatened with “ethics complaints” merely for presenting the data at the AAFS meeting (TFSC Tr. 198, 213-214).

Because the ABFO had resorted to “personal attacks rather than” to “embrace, at any level, the research,” Dr. Freeman – the president-elect of the ABFO – considered resigning from the

organization. Dr. Senn responded by indicating that Dr. Freeman should have anticipated such personal attacks, commenting, “Gets hot in the kitchen, doesn’t it.” (TFSC Tr. 213-214).

Even if the bite mark community appears to be in uniform agreement—which it plainly is not—such unanimity may reflect more the sustained efforts of bite mark defenders to oust anyone from the circle who acknowledges reality, than true general acceptance. The TFSC recognized this unscientific behavior and noted its dire consequences:

During one of the Bitemark Panel meetings, Commissioners were told that recommending a moratorium on bitemark comparison would “hurt children.” The Commission disagrees. First, if anyone should take responsibility for the current state of bitemark comparison, it is the very organization of practitioners that, due to its glacial pace, reticence to publish critical data, and willingness to allow overstatements of science to go unchecked for decades, is facing a barrage of well-founded criticism While the

Commission understands and appreciates the important and helpful role forensic science plays in providing justice to victims, we must be vigilant to ensure the science used in criminal cases stands on a solid foundation of research and data, both for the benefit of victims and the accused.

Ex Z at 12 (TFSC Report). Likewise PCAST wrote that “[s]ome practitioners have expressed concern that the exclusion of bitemarks in court could hamper efforts to convict defendants in some cases. If so, the correct solution, from a scientific perspective, would not be to admit expert testimony based on invalid and unreliable methods, but rather to attempt to develop scientifically valid methods.” Ex. Y at 87 (PCAST Report).

The conclusions of the National Academy of Sciences, the Texas Forensic Science Commission, and the various academic researchers, scientists, scholars, forensic odontologists, and courts who have weighed in on the issue demonstrate that, at whatever level it is defined, the scientific community no longer generally accepts bite mark evidence as reliable. Such evidence thus fails both *Frye* and Rule 702 and should be deemed inadmissible by this court.

# The Prejudicial Impact of Bite Mark Evidence Outweighs Any Possible Probative Value

“In determining the admissibility of evidence, the trial court must decide whether the evidence is relevant and, if so, whether its probative value outweighs its prejudicial effect.” *Com. v. Matthews*, 783 A.2d 338, 340 (Pa. Super. Ct. 2001) (citing *Com. v. Crews*, 640 A.2d 395 (Pa. Super. Ct. 1994)); Pa.R.E. 403 (“The court may exclude relevant evidence if its probative value is outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence.”). As the foregoing demonstrates, there is no probative value in bite mark evidence, and for that reason, it has been entirely rejected by the scientific community. But even if this Court were to determine that there might be some value in bite mark evidence, it is plain that the prejudicial impact of such evidence grossly outweighs any potential probative value.

As an initial matter, even if it were possible for a forensic dentist to, as the ABFO suggests, “include” a person as potentially having made a mark (a possibility, it bears repeating, entirely foreclosed by the significant research on dentition uniqueness and on skin’s ability to accurately record that uniqueness discussed *supra* Part I.2(a)), how many other people would also be “included” is unknown. *See* Ex. C at 174 (NAS Report) (finding “there is no established science indicating what percentage of the population or subgroup of the population could also have produced [a] bite”). Thus the jury has no way of knowing whether one in ten people could have produced a particular mark or one in ten million people. The potential that they will conclude, without any support, that it is the latter is simply too dangerous to permit.

This danger is especially heightened where the testimony to be offered appears to be “scientific,” as here. Courts have long recognized that such “scientific” “expert” evidence can carry great but unwarranted weight with jurors. *See Daubert v. Merrell Dow Pharm., Inc.*, 509

U.S. 579, 595 (1993) (“Expert evidence can be both powerful and quite misleading because of

the difficulty in evaluating it.”); *United States v. Frazier*, 387 F.3d 1244, 1263 (11th Cir. 2004) (“Simply put, expert testimony may be assigned talismanic significance in the eyes of lay jurors, and, therefore, the . . . courts must take care to weigh the value of such evidence against its potential to mislead or confuse.”). Scholars, too, have recognized that jurors are, even under the best of circumstances, likely to overvalue forensic evidence. *See*, *e.g.*, Keith A. Findley, *Innocents at Risk: Adversary Imbalance, Forensic Science, and the Search for Truth*, 38 SETON HALL L. REV. 893, 948 (2008) (“[R]esearch indicates that jurors often do not understand the fundamentals of scientific evidence, and lack the ability to reason about statistical, probabilistic, and methodological issues effectively.”); Mark A. Godsey & Marie Alao, *She Blinded Me with Science: Wrongful Convictions and the “Reverse CSI Effect*,*”* 17 TEX. WESLEYAN L. REV 481, 495 (2011) (noting that “jurors in this country often accept state forensic testimony as if each prosecution expert witness is the NASA scientist who first put man on the moon”); Tom R. Tyler, *Viewing CSI and the Threshold of Guilt: Managing Truth and Justice in Reality and Fiction*, 115 YALE L.J. 1050, 1068 (2006) (“There is widespread evidence indicating that people already overestimate the probative value of scientific evidence.”); Richard H. Underwood, *Evaluating Scientific and Forensic Evidence*, 24 AM. J. TRIAL ADVOC. 149, 166 (2000) (“Given their lack of scientific sophistication and innumeracy, jurors are likely to overestimate the significance of [expert testimony].”).

Aside from the serious risk that it will be overvalued by the jury, it bears noting that bite mark evidence itself is also inherently prejudicial. Any testimony connecting a person to a bite mark is testimony that, by its nature, tells the jury that person committed the act of an animal. To permit such testimony in the absence of scientific proof that such comparisons are possible is to gravely prejudice the jury against Mr. Doe with virtually no probative value to outweigh it.

Moreover, even if this Court were to find (contrary to *all* of the available scientific evidence) that bite marks can be used to include or exclude a suspected dentition, the Commonwealth has still failed to grapple with the fundamental truth that neither Dr. Asen nor anyone else on earth has any idea how many other people could have made the mark on the victim. Despite Dr. Asen’s (completely unscientific) examination of four other potential “biters,”[26](#_bookmark25) there is no way of knowing how many other people on earth could also have caused this injury. Neither the jury nor the court can appropriately weigh the “value” (however negligible) of such evidence given this incredible lack of data. The unfair prejudice derived from this alone renders any bite mark evidence inadmissible as a matter of Rule 403. *See* Pa.R.E. 403 (permitted exclusion of “evidence if its probative value is outweighed by a danger of . . . unfair prejudice”).

The value of bite mark evidence is, at best, negligible. Given that, and given the serious risks that its introduction would mislead the jury, it must be excluded.

# The Admission of Bite Mark Evidence Would Violate Mr. Doe’s Constitutional Rights

The introduction of bite mark evidence would not only flout *Frye* and Rules 702 and 403, but also violate Mr. Doe’s due process rights under both the Federal and Pennsylvania constitutions to a trial free of false evidence. “[I]t is established that a conviction obtained through use of false evidence, known to be such by representatives of the State, must fall under the Fourteenth Amendment.” *Napue v. Illinois*, 360 U.S. 264, 269 (1959); U.S. Const. amend.

XIV; Pa. Const. art. I, § 9; *Com. v. Turner*, 80 A.3d 754, 763 (Pa. 2013) (noting that “Article I,

26 In addition to its complete rejection of bite mark evidence, PCAST specifically noted that “[t]he [ABFO] bitemark standards do not provide well-defined standards concerning the degree of similarity that must be identified to support a reliable conclusion that the mark could have or could not have been created by the dentition in question.

Conclusions about all these matters are left to the examiner’s judgment.” Ex. Y at 83 (PCAST Report).

Section 9 of the Pennsylvania Constitution guarantees a criminal defendant the right to due process of law” and that this provision is “largely coextensive” with the Fourteenth Amendment). Evidence is false if it gives jury a “false impression.” *Alcorta v. Texas*, 355 U.S. 28, 31 (1957).

Such a false impression would plainly be made here if bite mark evidence were introduced at trial. Indeed, *any* testimony purporting to link Mr. Doe with a bite mark at *any* level would be entirely without basis in science, and thus false as a matter of law. *Ex parte Graf*, No. AP-77,003, 2013 WL 1232197, at \*1 (Tex. Crim. App. Mar. 27, 2013) (unpublished case) (finding that “[f]alse expert testimony at Applicant’s trial violated his due process rights” where that testimony was based on “applications of scientific principles to fire investigation [that] ha[d] advanced since the time of applicant’s trial”); *see also Han Tak Lee v. Glunt*, 667 F.3d 397, 407 (3d Cir. 2012) (finding petitioner’s claims that he was denied due process through the introduction of scientific evidence exposed after trial to be unreliable, “if proven, set forth a *prima facie* case for granting [him] habeas relief on his due process claim by showing that the admission of the Commonwealth's fire expert testimony undermined the fundamental fairness of [his] entire trial because the testimony was premised on unreliable science and was therefore itself unreliable”).

This is not a situation in which the defense expert “simply disagrees” with the state’s expert about “the validity of the scientific theories” that expert relied upon. *Compare Com. v. Henry*, 706 A.2d 313, 321 (Pa. 1997) (“Simply because Henry's experts disagree with the Commonwealth’s experts does not mean that the Commonwealth knowingly presented false evidence in violation of Henry’s due process rights.”). Rather, this is a case in which the validity of those theories has been rejected by every facet of the scientific community. Where such

independent bodies as the National Academy of Sciences and the Texas Forensic Science Commission have rejected bite marks as unreliable, to say nothing of the countless other scientists and scholars who have joined them, its use by the Commonwealth can only constitute a deprivation of Mr. Doe’s fundamental due process rights. Their conclusions, and the conclusions to be drawn from the entire body of scientific knowledge to date in this area, make plain that any testimony which would suggest to the jury that a forensic odontologist could reliably, and with any degree of certainty, associate a bite mark to an individual, and that he had done so in this case, would be completely false. Science plainly shows no such comparison is possible. If the Commonwealth offers such testimony, it does so knowing that that testimony is false and would violate Mr. Doe’s due process rights. *See Miller v. Pate*, 386 U.S. 1, 7 (1967) (finding violation of Fourteenth Amendment where prosecutor knowingly offered false testimony that “blood stained” item was in actuality stained with paint).

# Conclusion

Bite mark comparison evidence has no basis in science and has accordingly been rejected by the scientific community, however broadly or narrowly that community is defined. Mr. Doe thus moves for its exclusion from his trial as matter of *Frye*, Pennsylvania Rules of Evidence 702 and 403, and his due process rights under the state and federal constitution. If this court does not exclude this evidence outright, Mr. Doe alternatively moves for a hearing to examine the technique’s reliability and general acceptance.

# Exhibits:

1. Dennis Asen Testimony, November 2, 2005 (“Asen Testimony”)
2. Amici Curiae Brief of Michael J. Saks, Thomas Albright, Thomas L. Bohan, Barbara E. Bierer and 34 Other Scientists, Statisticians and Law-And-Science Scholars and Practitioners In Support Of the Petition for Writ of Habeas Corpus by William Joseph Richards (“Scientists’ Brief”)
3. National Academy of Sciences, Committee on Identifying the Needs of the Forensic Sciences Community, *Strengthening Forensic Science in the United States: a Path Forward* (2009) (“NAS Report”)
4. Mary A. Bush, Peter J. Bush & H. David Sheets, *Statistical Evidence for the Similarity of the Human Dentition*, 56 J. Forensic Sci. 118 (2011)
5. H. David Sheets et al., *Dental Shape Match Rates in Selected and Orthodontically Treated Populations in New York State: A Two Dimensional Study*, 56 J. FORENSIC SCI. 621 (2011)
6. Mary A. Bush, Peter J. Bush & H. David Sheets, *Similarity and Match Rates of the Human Dentition In 3 Dimensions: Relevance to Bitemark Analysis*, 125 INT. J. LEG. MED. 779 (2011)
7. H. David Sheets et al*.*, *Patterns of Variation and Match Rates of the Anterior Biting Dentition: Characteristics of a Database of 3D-Scanned Dentitions*, 58 J. FORENSIC SCI. 60 (2013)
8. Mary A. Bush et al., *A Study of Multiple Bitemarks Inflicted in Human Skin by a Single Dentition Using Geometric Morphometric Analysis*, 211 FORENSIC SCI. INT. 1 (2011)
9. Mary A. Bush et al., *The Response of Skin to Applied Stress: Investigation of Bitemark Distortion in a Cadaver Model*, 55 J. FORENSIC SCI. 71 (2010)
10. Mary A. Bush et al., *Inquiry into the Scientific Basis For Bitemark Profiling and Arbitrary Distortion Compensation*, 55 J. FORENSIC SCI. 976 (2010)
11. (Raymond G. Miller et al., *Uniqueness of the Dentition as Impressed in Human Skin: A Cadaver Model*, 54 J. FORENSIC SCI. 909 (2009)
12. Mary A. Bush et al., *Biomechanical Factors in Human Dermal Bitemarks in a Cadaver Model*, 54 J. FORENSIC SCI. 167 (2009)
13. Radley Balko, *A Bite Mark Matching Advocacy Group Just Conducted A Study That Discredits Bite Mark Evidence*, WASHINGTON POST, April 8, 2015 (“Balko, Advocacy”)).
14. Mark Page, et al., *Expert Interpretation of Bitemark Injuries—A Contemporary Study*, 58(3) J. FORENSIC SCI. 664 (May 2013)
15. C. Michael Bowers, Problem-Based Analysis of Bitemark Misidentifications: The Role of DNA, 159S FORENSIC SCI. INT'L S104 (2006)
16. Amanda Lee Myers, *Bites Derided as Unreliable in Court*, ASSOCIATED PRESS, June 16, 2013, available at <http://bigstory.ap.org/article/ap-impact-bites-derided-unreliable-court>
17. Innocence Project, *List of Wrongful Bite Mark Convictions and Indictments*
18. Transcript of the Nov. 16, 2015, Bite Mark Panel meeting of the Texas Forensic Science Commission (“TFSC Tr.”)
19. Erik Eckholm, *Texas Panel Calls for an End to Criminal IDs via Bite Mark,* N.Y. TIMES, Feb. 12, 2016, at A10 (“Eckholm, Texas”)
20. Joe Palazzolo, *Texas Commission Recommends Ban on Bite-Mark Evidence*, Wall St. J., Feb. 12, 2016
21. Allan Turner, *Forensic Science Commission Urges Moratorium On "Bite Mark" Evidence In Texas Trial: Commission Deems It Flawed As Evidence*, HOUSTON CHRONICLE, Feb. 12, 2016
22. Transcript of Post-Conviction Relief Act Proceedings, *Commonwealth of Pennsylvania v. Crystal Dawn Weimer* (“Weimer Transcript”)
23. Jerry Mitchell, *Bite Mark Expert Dismisses Own Testimony*, CLARION LEDGER, June 20, 2015
24. *Ex Parte Steven Mark Chaney,* Agreed Findings of Fact and Conclusions of Law on Applicant’s Subsequent Writ of Habeas Corpus, Dist. Ct. 4, Dallas Cty. Tx. (Oct. 12, 2005) (“Chaney Findings”)
25. President’s Council of Advisors on Science and Technology, *Report to the President: Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature- Comparison Methods*, Sept. 2016 (“PCAST Report”)
26. Texas Forensic Science Commission, *Forensic Bitemark Comparioson Complaint Filed by National Innocence Project on Behalf of Steven Mark Chaney- Final Report, Finalized at Quarterly Meeting, April 12, 2016* (“TFSC Report”)

AA. Email from Dr. Eric Lander to American Academy of Forensic Sciences Membership, dated December 2, 2016

BB. President’s Council of Advisors on Science and Technology, *An Addendum to the PCAST Report On Forensic Science In Criminal Courts*, January 2017 (“PCAST Addendum”)

CC. Hon. Harry T. Edwards, *The National Academy of Sciences Report on Forensic Sciences: What it Means for the Bench and Bar, Presentation at the Superior Court of the District of Columbia* (May 6, 2010) (“Edwards Presentation”)

DD. Radley Balko, *Attack Of The Bite Mark Matchers*, WASHINGTON POST, Feb. 18, 2015 EE. Texas Forensic Science Commission, Commission Members (Feb. 26, 2016)